FORUM

Innovations for Pest Control in Produce

Postharvest control of insect pests is an integral part of maintaining safe, high-quality, abundant produce domestically and for export. Insect pests can travel with fresh produce from the field and into processing plants and storage facilities. Agricultural Research Service scientists have found many innovative and environmentally friendly methods to help meet this challenge.

ARS laboratories in Manhattan, Kansas, and Gainesville, Florida, in collaboration with others, are using unique ways to detect and disinfest stored-grain facilities of insect pests like the red flour beetle, a major pest of the flour-milling industry. Effective pest detection and monitoring are critical to pest management because they provide necessary information for timing and targeting the application of control measures.

Researchers in Gainesville have developed a new trap for monitoring the presence of red flour beetles. The trap uses ultraviolet light, a chemical attractant, and a physical configuration that guides beetles into a pit where they become trapped. This monitoring tool has promise for use in flour mills and other food-processing plants.

In Manhattan, Kansas, ARS scientists are trying to slow the growth of red flour beetle populations by altering its hormonal system. Treatment with growth regulators can kill immature insects, and survivors may have reduced fitness. When larvae were exposed to growth regulators, males were less likely to survive to the adult stage than females. Adult males that survived larval exposure to growth regulators produced fewer offspring than unexposed males. Results show that the nonlethal effects of growth regulators potentially increase the impact of insecticide treatments on population growth rates, thus making growth regulators more effective in pest management than initially estimated.

The dried fruits and tree nuts industry also requires insect pest control measures. Much of the U.S. production of dried fruits and tree nuts occurs in the Central Valley of California. To provide consumers with quality produce, processors must control postharvest insect pests. Scientists in Parlier, California, are developing nonchemical treatments to solve this issue, using temperature extremes or vacuum, as well as insect parasitoids as control agents. The target pests for most of this work include both field pests of postharvest significance and stored-product pests. Several methods are being tested, including cold storage for spotted wing *Drosophila* on grapes, radio frequency treatments for cowpea weevil in dried pulses, and low-temperature vacuum treatments for codling moth in fresh fruits.

Another insect, the Indianmeal moth, is globally the most important stored-product moth pest. ARS scientists in Parlier, along with collaborators from the University of Michigan, demonstrated that mating disruption controls Indianmeal moth in dried beans in central California. Mating disruption is safer and less disruptive than fumigants and aerosol sprays, but it is less widely used for control of Indianmeal moth. This demonstration of successful control of the Indianmeal moth will encourage adoption of mating disruption, thereby protecting food in distribution channels while reducing use of insecticides and improving worker safety.

The possible presence of the Asian citrus psyllid in loads of citrus arriving in Australia threatens California's ability to export citrus into that market. Parlier researchers found that Asian citrus psyllids are completely washed from fruits that are submerged, flooded, or sprayed at high temperatures using soak tanks and wash lines consistent with commercial practices in California. Nearly 99 percent of the insects remain trapped by the solution until they drown, and that means that Asian citrus psyllids will very likely not be present in commercially packed fruit. This research will help maintain access of California citrus to Australia, a market valued at $60 million annually.

Also on the world stage, tephritid fruit flies are serious economic pests worldwide. The larval stages feed within host fruits, making infestation difficult to detect. Fruit imported into the United States is currently checked for infestation by cutting open a small sample of fruit and looking for fly larvae. This is a time-consuming and potentially limited way to detect the insect, so more sensitive screening methods are needed. USDA-ARS scientists in Miami, Florida, in conjunction with USDA's Animal and Plant Health Inspection Service, also in Miami, conducted research to evaluate gas chromatography (GC) as a detection method. Grapefruits infested with larvae of the Caribbean fruit fly were examined to determine whether infested fruit emitted chemicals distinct from those of healthy fruit. GC analysis indicated that there were volatile chemicals indicative of citrus fruit injury and others associated with larval infestation. These "signature chemicals" were also detectable with a portable, ultra-fast GC analyzer. This is just one example of studies that hold the potential in development of a rapid screening protocol for detection of infested fruit at U.S. ports of entry.

The article on oxygenated phosphine fumigation, on page 10 of this issue, is another example of ARS research on ways to make U.S. produce as free of insect pests as possible for the consumer.

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